PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-049462
(43)Date of publication of application : 20.02.2001

(51)Int.Cl. C23C 24/08
B05D 3/04
C23C 20/02

(21)Application number : 11-224007
(22)Date of filing : 06.08.1999

(71)Applicant : KANTO YAKIN KOGYO KK
(72)Inventor : TAKAHASHI SUSUMU

(54) METAL COATING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for coating the surface of iron, copper or the alloys thereof with metal.
SOLUTION: The powder of metal for coating of nickel, copper, manganese, iron, chromium, silicon, tin, zinc, aluminum or the alloys thereof is added with a binder and a solvent to form into a pasty shape, the pasty powder is applied on the desired surface of substrate metal of iron, copper or the alloys thereof, which is thereafter dried, and the substrate metal in which the metal for coating is dried and formed into the surface in this way is thereafter heated in an inert protecting atmosphere.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]covering which becomes nickel, copper, manganese, iron, chromium, silicon, tin, zinc aluminum, or these alloys -- public funds -- a binder and a solvent being added to powder of a group, and it being made pastiness, and, drying, after applying this pultaceous powder to the surface of a request of iron, copper, or base substance metal of these alloys, and doing in this way -- the surface -- covering -- public funds -- metallization heating base substance metal which a group dried and became a film under a protective atmosphere [inertness after that].
[Claim 2]the surface -- covering -- public funds -- heating this base substance metal under an inertness protective atmosphere, after assembling plurality of base substance metal which a group dried and became a film in predetermined form -- covering -- public funds -- the metallization according to claim 1, wherein a part of group flows into contacting parts between base substance metal and it joins these contacting parts of each other.
[Claim 3]The metallization according to claim 1 or 2 choosing from hydrocarbon of a kind which volatilizes without carbonizing at the time of heating which chose from resin with the membrane formation nature of a kind which does not act as a side student of the carbon at the time of desiccation which described a binder above, and heating, and described a solvent above.
[Claim 4]The metallization according to claim 1, 2, or 3 adding fluoride to said pultaceous powder further.
[Claim 5]The metallization according to claim 1, 2, 3, or 4, wherein said inertness protective atmosphere consists of argon or nitrogen.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the method of covering the surface of iron, copper, or these alloys with metal.
[0002]
[Description of the Prior Art]The surface of iron, copper, or these alloys has been covered with metal by various methods by the purpose, such as corrosion-resistant improvement, hardening, smoothing, or beautification.
[0003]There are a method of painting metal at ordinary temperature, a method of plating metal with ordinary temperature, the method of covering metal with a spraying process, etc. After investing the base substance metal by which metallic coating is carried out into molten metal and making covering of the molten metal of the liquid phase form in the surface of base substance metal, the hot-dipping method which cools this to ordinary temperature is widely used as a method of covering zinc and aluminum on the surface of a griddle.
[0004]
[Problem to be solved by the invention]Although the conventional metallization mentioned above balances the purpose of each metallic coating, Metaled covering could be made easily and certainly on the surface of base substance metal, and it has looked forward to the technique of being plating etc. or moreover, causing a public nuisance in this covering, and the metallization which does not need processing.
[0005]
[Means for solving problem]When nickel, copper, manganese, iron, chromium, silicon, tin, zinc, aluminum, or these alloys cover the surface of a request of iron, copper, or these alloys in this invention, These metal for covering is powdered, and a binder and a solvent are added to this metal powder, and it is considered as pastiness, and applies to the surface of a request of iron and copper used as the base substance metal which described this above, or these alloys. This is heated to relatively high temperature under a protective atmosphere [inertness ordinary temperature or after heating and drying at low temperature comparatively], and desired metallic coating is made on base substance metal.
[0006]it does not drop out easily on the surface of a request of base substance metal without being based on methods, such as plating, -- as -- covering -- public funds -- a group can be applied and the metallic coating close to base substance metal can be obtained by heat-treating this under a protective atmosphere [inertness / nitrogen / argon,]. Namely, the thing which the metallization by this invention powders a covering metal, and this is made into pastiness, and is applied to base substance metal, Thus, it is characterized by heat-treating the base substance metal in which the covering metal was applied under an inertness protective atmosphere, The metallization of this invention which consists of this feature is new, from the metallic coating method learned until now, can do neither expectation nor an idea at all, and has the effect which was excellent as mentioned above.
[0007]In order to make a covering metal into pastiness, it is important not to act as a side student of the carbon which the binder used by the method of this invention has membrane formation nature, and blocks covering also at the time of the heat-treatment under an inertness protective atmosphere.
[0008]Also as for the solvent used by the method of this invention, it is important to volatilize without carbonizing, by the time temperature up of the base substance metal in which the covering metal was applied is carried out to the objective temperature of heat-treatment. It is because **** to the base substance metal of a covering metal will be blocked in this portion and the membrane formation nature of a covering metal will be spoiled, if carbon arises. Therefore, as a binder, acrylic resin, isobutylene isoprene rubber, etc. are preferred, and the diluent of toluene or hydrocarbon of other petroleum systems is suitable for a solvent.
[0009]Although the atmosphere of argon, nitrogen, etc. is used as an inertness protective atmosphere used for heat-treatment, the metal which is not returned under this kind of atmosphere -- covering -- public funds, when the group contains, By adding a small quantity of fluorides, such as tetrafluoro aluminum acid potassium, potassium fluoride, and tetraboric acid sodium, in a covering metal, the liquid phase salt of fluoride melts metal oxide, the surface is activated, and a wettability is improved. As for the melting point of this fluoride, it is desirable that it is lower than the melting point of a powder covering metal 10 thru/or 100 **.
[0010]
[Mode for carrying out the invention]The following working examples explain further the metallization which becomes this invention.
AKURIDEIKKU (Dainippon Ink and Chemicals Inc. trade name) 1.2 which is acrylic resin as a binder for giving 78 weight % of nickel powder and membrane formation nature which are metal for working-example 1 covering Weight %, as the dispersing agent for preventing precipitate of 18.2 weight % of toluene and metal powder as a solvent -- AKURO wax (Lonza trade name) 2.6 weight % -- pultaceous covering -- public funds -- the coating material of the group was made.
[0011]The spatula was used for one surface of the 80mmx80mmx1mm griddle (S10C), this was applied by a thickness of about 50 microns, and it dried for 10 minutes at ordinary temperature. The coat of the covering metal in which the exfoliation or omission from a griddle do not occur by this even if it grinds against a finger was formed.
[0012]This was heated for 30 minutes at 1200 ** in the argon atmosphere of a high grade. As a result, the carbonaceous by an organic matter was not seen but the surface of the covering metal presented metallic luster. When the covering metal was firmly pasted up on the griddle of the base substance and the organization of the section was observed under the microscope, it turned out that the diffusion phase is formed between a covering metal film and a griddle. This was immersed in salt water for one week

10%, and was observed about the existence of rusting. Although rust occurred in the field which is not covered with a covering metal, generating of rust was not observed in the field of the side covered with the covering metal at all, but excelling in corrosion resistance became whether to be **.

[0013]working-example 2 covering -- public funds -- AKURIDEIKKU 3.7 of 44.3 weight % of copper powder which contains 24 weight % of manganese as a group, and a binder -- pultaceous covering which weight %, potassium fluoride 7.5 weight % which works as a reducing agent and specific fluoride 7.5 weight %, and the remainder become from toluene of a solvent -- public funds -- the coating material of the group was made.

[0014]This was applied to the surface of the soft iron board (SS41) of thickness 2.3 mm by a thickness of about 75-150 microns, and when it heated and dried at 120 **, the metallic film which is not omitted from a soft iron board even if it grinds against a finger was formed.

[0015]This was further heated for 20 minutes at 920 ** in the argon atmosphere of a high grade. As a result, the metallic coating of the alloy of copper and manganese was able to be obtained via the layer of the intermetallic compound of iron, copper, and manganese on the soft iron board. It is just going to be known widely that the metallic coating of this alloy will prevent iron corrosion.

[0016]working-example 3 covering -- public funds -- covering which 10 weight % of AKURI decks and the remainder become from toluene of a solvent as a group as 50 weight % of stainless steel (SUS304) powder whose average particle size is 8 microns, and a binder -- public funds -- the coating material of the group was made.

[0017]When about 70-100-micron spray coating was performed for this on the surface of the soft iron board (SS400) of thickness 2.3 mm and this was heated at 80 **, the coat of the covering metal which is not omitted from a soft iron board even if it grinds against a finger was formed. This was further heated for 20 minutes at 1200 ** in the argon atmosphere of a high grade. As a result, the good stainless steel coat of adhesion was able to be obtained on the soft iron board.

[0018]covering which AKURO wax 2.8 weight % and the remainder become from toluene of a solvent as AKURI deck 8.3 weight % and a dispersing agent as 69 weight % of silicon powder whose average particle size is 5 microns as working-example 4 covering metal, and a binder -- public funds -- the coating material of the group was made.

[0019]When brush coating was performed so that it might become about 50-70 microns on the surface of a 3-mm-thick pure copper board about this, and this was heated at 80 **, the coat of the covering metal which is not omitted from a pure copper board even if it grinds against a finger was formed. This was further heated for 20 minutes at 1000 ** in the argon atmosphere of a high grade. As a result, the good silicon copper film of adhesion was able to be obtained to the pure copper board.

[0020]isobutylene-isoprene-rubber 6.8 weight % as 70 weight % of copper powder containing 25 weight % of working-example 5 tin, and a binder, and pultaceous covering which the remainder becomes from toluene -- public funds -- the coating material of the group was made and thickness applied this to the surface of the pure copper board of 3.2 mm by a thickness of 45-75 microns. When this was heated at 120 ** and it dried, the coat which does not fall out from a copper plate even if it grinds against a finger was formed on the copper plate. When this was heated for 20 minutes at 905 ** in the furnace of the argon atmosphere of a high grade, the metallic coating of the alloy of copper and tin well stuck to the metallographic target to a pure copper board was able to be obtained. This metallic coating has corrosion resistance, and it also has heat-conducting characteristic.

[0021]Like the working example 5 above-mentioned working-example 6, the same coating material was applied to the wafer of two pure copper boards, and it heated like the working example 5 which described this wafer above, and dried. Then, this wafer was assembled in the shape of a T character, and was heated in the atmosphere furnace like the above-mentioned working example 5.

[0022]Some covering metals flowed and solidified in the contacting parts of the wafer of two sheets, and by these contacting parts, the wafer of two sheets was mutually brazed firmly by copper and the tin alloy, and was united with it. Copper is well protected from corrosion as the alloy plate of wrap copper and tin described above the surfaces and those contacting parts of the pure copper plate piece.

[0023]covering which AKURO wax 2.8 weight % and the remainder become from toluene of a solvent as AKURI deck 8.3 weight % and a dispersing agent as a binder 69weight % in the end of zinc dust whose average particle size is 10 microns as working-example 7 covering metal -- public funds -- the coating material of the group was made.

[0024]When brush coating was performed so that thickness might be about 50-70 microns on the surface of a 3-mm-thick pure copper board about this, and this was heated at 80 **, the coat of the covering metal which is not omitted from a pure copper board even if it grinds against a finger was formed.

[0025]This was further heated for 20 minutes at 800 ** in the argon atmosphere of a high grade. As a result, the good brass coat of adhesion was able to be obtained to the pure copper board.

[0026]60 weight % of aluminium powders whose average particle size is 5 microns as working-example 8 covering metal, covering which 8 weight % of AKURI decks, 10 weight % of NOKOROKKU flux (mixture of tetrafluoro aluminum acid potassium and potassium fluoride) of the fluoride which works as flux, and the remainder become from toluene of a solvent as a binder -- public funds -- the coating material of the group was made.

[0027]When spray coating was performed so that thickness might be about 90-100 microns on the surface of a 2-mm-thick soft iron board (SS400) about this, and this was neglected for 10 minutes to the room temperature, the coat of the covering metal which is not omitted from a griddle even if it grinds against a finger was formed.

[0028]This was further heated for 20 minutes at 700 ** in the nitrogen atmosphere of a high grade. As a result, the good aluminum outer steel shell film of adhesion was able to be obtained to the griddle.

[0029]covering of the metallization according to this invention at the above-mentioned working example -- public funds, although nickel, copper, manganese, iron, chromium, silicon, tin, zinc, and aluminum were used with the simple substance or the alloy as a group, Although each of these could be used by the method of this invention also as a simple substance and each alloy, respectively and ******** of this use was not mentioned above as an working example, this use is just going to be confirmed in an experiment.

[0030]

[Effect of the Invention]According to [passage clear from the place mentioned above] the method of this invention, on the surface of a request of iron, copper, or the base substance metal of these alloys. covering of nickel, copper, manganese, iron and chromium which are rich in corrosion resistance etc., silicon, tin, zinc, aluminum, or these alloys -- public funds -- covering of a group can be made easily and certainly.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2001－49462
(P2001－49462A)
(43)公開日　平成13年２月20日(2001.2.20)

(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード(参考)
Ｃ２３Ｃ　24/08		Ｃ２３Ｃ　24/08	Ａ	４Ｄ０７５
Ｂ０５Ｄ　3/04		Ｂ０５Ｄ　3/04	Ａ	４Ｋ０２２
Ｃ２３Ｃ　20/02		Ｃ２３Ｃ　20/02		４Ｋ０４４

審査請求　未請求　請求項の数５　ＯＬ　（全４頁）

(21)出願番号　特願平11－224007

(22)出願日　平成11年８月６日(1999.8.6)

(71)出願人　00015/072
関東冶金工業株式会社
神奈川県平塚市四之宮2543番地
(72)発明者　高橋　進
神奈川県横浜市保上ケ谷区新桜ケ丘一丁目12番地３
(74)代理人　100078709
弁理士　浅賀　一樹

最終頁に続く

(54)【発明の名称】　金属被覆法

(57)【要約】　（修正有）
【課題】　鉄、銅、またはこれらの合金の表面を金属で被覆する方法。
【解決手段】　ニッケル、銅、マンガン、鉄、クロム、シリコン、錫、亜鉛、アルミニウムまたはこれらの合金になる被覆用金属の粉末にバインダーと溶剤とを加えて糊状にし、この糊状の粉末を鉄、銅またはこれらの合金の基体金属の所望の表面に塗布した後に乾燥し、このようにして表面に被覆用金属が乾燥して被膜となった基体金属をその後に不活性な保護雰囲気下で加熱する、金属被覆法。

【特許請求の範囲】
【請求項１】　ニッケル、銅、マンガン、鉄、クロム、シリコン、錫、亜鉛アルミニウムまたはこれらの合金になる被覆用金属の粉末にバインダーと溶剤とを加えて糊状にし、この糊状の粉末を鉄、銅またはこれらの合金の基体金属の所望の表面に塗布した後に乾燥し、このようにして表面に被覆用金属が乾燥して被膜となった基体金属をその後に不活性な保護雰囲気下で加熱することを特徴とする金属被覆法。
【請求項２】　表面に被覆用金属が乾燥して被膜となった基体金属の複数を所定の形状に組み立てた後に、この基体金属を不活性な保護雰囲気下で加熱し、被覆用金属の一部が基体金属間の接触部分に流れて、この接触部分を互いに接合することを特徴とする請求項１記載の金属被覆法。
【請求項３】　バインダーを前記した乾燥時と加熱時に炭素を傍生しない種類の成膜性のある樹脂から選択し、かつ溶剤を前記した加熱時に炭化することなしに揮発する種類の炭化水素から選択することを特徴とする請求項１又は２記載の金属被覆法。
【請求項４】　前記糊状の粉末に更に弗化物を加えることを特徴とする請求項１、２又は３記載の金属被覆法。
【請求項５】　前記した不活性な保護雰囲気がアルゴンまたは窒素からなることを特徴とする請求項１、２、３又は４記載の金属被覆法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、鉄、銅、またはこれらの合金の表面を金属で被覆する方法に関するものである。
【０００２】
【従来の技術】鉄、銅、またはこれらの合金の表面は、耐蝕性の向上、硬化、平滑化、或いは美化等の目的で様々な方法で金属により被覆されてきた。
【０００３】常温で金属を塗装する方法、常温で金属をメッキする方法や、溶射法で金属を被覆する方法等がある。また、溶融金属中に金属被覆される基体金属を投入し、基体金属の表面に液相の溶融金属の被覆を形成させた後に、これを常温まで冷却する溶融メッキ法は、鉄板の表面に亜鉛やアルミニウムを被覆する方法として広く用いられている。
【０００４】
【発明が解決しようとする課題】上述した従来の金属被覆法はそれぞれの金属被覆の目的に見合うものであるが、基体金属の表面に金属の被覆を容易かつ確実に作ることができ、しかもこの被覆にメッキ等のあるいは公害を引き起こすかも知れないような手法と処理を必要としない金属被覆法が待望されてきた。
【０００５】
【課題を解決するための手段】本発明では、鉄、銅またはこれらの合金の所望の表面を、ニッケル、銅、マンガン、鉄、クロム、シリコン、錫、亜鉛、アルミニウムまたはこれらの合金で被覆するとき、これらの被覆用金属を粉末とし、この金属粉末にバインダーと溶剤とを加えて糊状とし、これを前記した基体金属となる鉄、銅、またはこれらの合金の所望の表面に塗布する。これを常温または比較的低温で加熱して乾燥した後に、不活性な保護雰囲気下で比較的高温に加熱して、所望の金属被覆を基体金属上に作るものである。
【０００６】メッキ等の方法によらないで、基体金属の所望の表面に容易には脱落しないように被覆用金属を塗布することができ、これをアルゴンや窒素等の不活性な保護雰囲気下で加熱処理することにより、基体金属に密接した金属被覆を得ることができる。即ち、本発明による金属被覆法は、被覆金属を粉末として、これを糊状にして基体金属に塗布することと、このようにして被覆金属が塗布された基体金属を不活性な保護雰囲気下で加熱処理することを特徴とし、かかる特徴よりなる本発明の金属被覆法は新規であり、今までに知られる金属被覆方法からは到底予期も思い付きもできないものであり、かつ上述した如くに優れた効果を有するものである。
【０００７】被覆金属を糊状にするために、本発明の方法で用いられるバインダーは成膜性があり、かつ不活性な保護雰囲気下での加熱処理時にも被覆を妨害する炭素を傍生しないことが肝要である。
【０００８】また、本発明の方法で用いられる溶剤もまた、被覆金属が塗布された基体金属が加熱処理の目的温度に昇温されるまでに炭化することなく揮発することが肝要である。炭素が生じれば、この部分で被覆金属の基体金属への濡れが妨害され、被覆金属の成膜性が損なわれるからである。従って、バインダーとしては、アクリル系樹脂やブチルゴム等が好適であり、溶剤にはトルエンやその他の石油系の炭化水素の希釈液が好適である。
【０００９】加熱処理に用いられる不活性な保護雰囲気として、アルゴンや窒素等の雰囲気が用いられるが、この種の雰囲気下でも還元されない金属を被覆用金属が含んでいるときには、テトラフルオロアルミニウム酸カリウム、弗化カリウム、四ほう酸ナトリウム等の弗化物の少量を被覆金属中に添加することによって、弗化物の液相塩が酸化金属を溶かし、その表面を活性化して濡れ性を向上する。なお、かかる弗化物の融点は、粉末被覆金属の融点よりも１０乃至１００℃低いことが望ましい。
【００１０】
【発明の実施の形態】本発明になる金属被覆法を、以下の実施例によって更に説明する。
実施例１
被覆用金属であるニッケル粉末７８重量%、成膜性を持たせるためのバインダーとしてアクリル系樹脂であるアクリデイック（大日本インキ化学工業株式会社製の商品名）1.2 重量%、溶剤としてトルエン18.2重量%、およ

び金属粉末の沈殿を防ぐための分散剤としてアクロワックス（ロンザ社製の商品名）2.6 重量％とで、糊状の被覆用金属の塗布材を作った。

【００１１】これを、８０㎜×８０㎜×１㎜の鉄板（Ｓ１０Ｃ）の一方の表面にへらを用いて約５０ミクロンの厚さで塗布し、常温で１０分間乾燥した。これにより、指で擦っても鉄板からの剥離や脱落が起きない被覆金属の皮膜が形成された。

【００１２】これを、高純度のアルゴン雰囲気中で１２００℃で３０分間加熱した。その結果、有機物による炭素質は見られず、被覆金属の表面は金属光沢を呈した。また被覆金属は基体の鉄板に強固に接着しており、顕微鏡によってその断面の組織を観察したところ、被覆金属膜と鉄板との間に拡散相が形成されていることが分かった。また、これを、１０％塩水に一週間浸漬して、発錆の有無について観察した。被覆金属で覆われていない面には、錆が発生したが、被覆金属で覆われた側の面には全く錆の発生が認められず、耐蝕性に優れていることが明かになった。

【００１３】実施例２

被覆用金属としてマンガン２４重量％を含む銅粉末44.3 重量％、バインダーのアクリデイック3.7 重量％、還元剤として働く弗化カリウム7.5 重量％と弗化ナトリウム7.5 重量％、残部が溶剤のトルエンからなる糊状の被覆用金属の塗布材を作った。

【００１４】これを、厚さ2.3 ㎜の軟鉄板（ＳＳ４１）の表面に約７５～１５０ミクロンの厚さで塗布し、１２０℃に加熱して乾燥したところ、指で擦っても軟鉄板から脱落しない金属皮膜が形成された。

【００１５】これを更に、高純度のアルゴン雰囲気中で９２０℃で２０分間加熱した。その結果、軟鉄板上に鉄・銅・マンガンの金属間化合物の層を介して銅・マンガンの合金の金属被覆を得ることができた。かかる合金の金属被覆が鉄の腐食を防止することは広く知られているところである。

【００１６】実施例３

被覆用金属として、平均粒度が８ミクロンのステンレス鋼（ＳＵＳ３０４）粉５０重量％、バインダーとしてアクリデック１０重量％、残部が溶剤のトルエンからなる被覆用金属の塗布材を作った。

【００１７】これを厚さ2.3 ㎜の軟鉄板（ＳＳ４００）の表面に約７０～１００ミクロンのスプレー塗布を行ない、これを８０℃に加熱したところ、指で擦っても軟鉄板から脱落しない被覆金属の皮膜が形成された。これを、更に高純度のアルゴン雰囲気中で、１２００℃に２０分間加熱した。その結果、軟鉄板上に密着性の良いステンレス皮膜を得ることができた。

【００１８】実施例４

被覆金属として平均粒度が５ミクロンのシリコン粉末６９重量％、バインダーとしてアクリデック8.3 重量％、分散剤としてアクロワックス2.8 重量％、残部が溶剤のトルエンからなる被覆用金属の塗布材を作った。

【００１９】これを厚さ３㎜の純銅板の表面に、約５０～７０ミクロンになるようにハケ塗りを行ない、これを８０℃に加熱したところ、指で擦っても純銅板から脱落しない被覆金属の皮膜が形成された。これを、更に高純度のアルゴン雰囲気中で１０００℃に２０分間加熱した。その結果、純銅板に密着性の良いシリコン－銅皮膜を得ることができた。

【００２０】実施例５

錫２５重量％を含む銅粉末７０重量％、バインダーとしてのブチルゴム6.8 重量％、残部がトルエンからなる糊状の被覆用金属の塗布材を作り、これを厚さが3.2 ㎜の純銅板の表面に４５～７５ミクロンの厚さで塗布した。これを１２０℃で加熱して乾燥したところ、指で擦っても銅板から脱落しない皮膜が銅板上に形成された。これを高純度のアルゴン雰囲気の炉中で、９０５℃で２０分間加熱したところ、金相的に純銅板によく密着した銅・錫の合金の金属被覆を得ることができた。かかる金属被覆は耐蝕性を有すると共に、伝熱性をも有するものである。

【００２１】実施例６

上記した実施例５と同様に、同一の塗布材を２枚の純銅板の小片に塗布し、この小片を上記した実施例５と同様に加熱し乾燥した。そこで、この小片をＴ字状に組立て、上記した実施例５と同様に雰囲気炉中で加熱した。

【００２２】２枚の小片の接触部分に被覆金属の一部が流れて固まり、２枚の小片はこの接触部分で銅・錫合金によって互いに強固にろう付けされて、一体となった。純銅板片の表面とそれらの接触部分を覆う銅・錫の合金被覆は、上記した通り銅を腐食からよく防護するものである。

【００２３】実施例７

被覆金属として平均粒度が１０ミクロンの亜鉛粉末６９重量％、バインダーとしてアクリデック8.3 重量％、分散剤としてアクロワックス2.8 重量％、残部が溶剤のトルエンからなる被覆用金属の塗布材を作った。

【００２４】これを厚さ３㎜の純銅板の表面に厚さが約５０～７０ミクロンになるようにハケ塗りを行ない、これを８０℃に加熱したところ、指で擦っても純銅板から脱落しない被覆金属の皮膜が形成された。

【００２５】これを、更に高純度のアルゴン雰囲気中で、８００℃に２０分間加熱した。その結果、純銅板に密着性の良い黄銅皮膜を得ることができた。

【００２６】実施例８

被覆金属として平均粒度が５ミクロンのアルミニウム粉末６０重量％、バインダーとしてアクリデック８重量％、フラックスとして働く弗化物のノコロックフラックス（テトラフルオロアルミニウム酸カリウムと弗化カリウムの混合物）１０重量％、残部が溶剤のトルエンから

なる被覆用金属の塗布材を作った。

【００２７】これを厚さ２㎜の軟鉄板（ＳＳ４００）の表面に厚さが約９０～１００ミクロンになるようにスプレー塗布を行ない、これを室温に１０分間放置したところ、指で擦っても鉄板から脱落しない被覆金属の皮膜が形成された。

【００２８】これを、更に高純度の窒素雰囲気中で、７００℃に２０分間加熱した。その結果、鉄板に密着性の良いアルミニウム－鉄皮膜を得ることができた。

【００２９】なお、上記した実施例では、本発明による金属被覆法の被覆用金属として、ニッケル、銅、マンガン、鉄、クロム、シリコン、錫、亜鉛、アルミニウムを単体もしくは合金で用いたが、これらはいずれもそれぞれ単体としても、またそれぞれの合金としても本発明の方法で使用することができ、かかる使用のいちいちを実施例としては上記では挙げなかったが、かかる使用は実験で確かめられたところである。

【００３０】

【発明の効果】上述したところから明らかな通り、本発明の方法によれば、鉄、銅またはこれらの合金の基体金属の所望の表面に、耐蝕性等に富むニッケル、銅、マンガン、鉄、クロム、シリコン、錫、亜鉛、アルミニウムあるいはこれらの合金の被覆用金属の被覆を容易かつ確実に作ることができる。

フロントページの続き

Ｆターム(参考)　4D075 AE03 BB29Z BB60Z CA02
CA33 CA47 DA06 DA23 DB01
EA02 EA07 EB01 EB22 EC10
EC30
4K022 AA02 BA02 BA07 BA08 BA09
BA11 BA14 BA21 BA25 BA32
CA13 DA06 DA09 DB19 DB24
EA01
4K044 AA02 AA06 BA02 BA04 BA06
BA10 BA19 BA20 BA21 BC02
CA22 CA24 CA53 CA62

US 20090314448A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2009/0314448 A1

(43) Pub. Date: Dec. 24, 2009

Kuwabara et al.

(54) METHOD FOR PRODUCTION OF METAL MATERIAL

(75) Inventors: **Mitsuo Kuwabara**, Tsurugashima-shi (JP); **Tadashi Okada**, Saitama-shi (JP); **Naoji Yamamoto**, Shizuoka-ken (JP); **Masahito Hasuike**, Hamamatsu-shi (JP); **Michiharu Hasegawa**, Mie-ken (JP); **Tetsuaki Aoki**, Kumamoto-ken (JP); **Masanori Kogawa**, Kumamoto-ken (JP); **Kazunori Sakamoto**, Kumamoto-ken (JP); **Keizou Tanoue**, Kumamoto-shi (JP)

Correspondence Address:
CARRIER BLACKMAN AND ASSOCIATES
43440 WEST TEN MILE ROAD, EATON CENTER
NOVI, MI 48375 (US)

(73) Assignee: **Honda Motor Co., Ltd.**

(21) Appl. No.: **12/583,794**

(22) Filed: **Aug. 26, 2009**

Related U.S. Application Data

(62) Division of application No. 10/523,266, filed on Nov. 9, 2005, now Pat. No. 7,601,389, filed as application No. PCT/JP03/09737 on Jul. 31, 2003.

(30) **Foreign Application Priority Data**

Aug. 1, 2002 (JP) 2002-225216
Aug. 1, 2002 (JP) 2002-225220
Aug. 1, 2002 (JP) 2002-225228
Aug. 1, 2002 (JP) 2002-225231
Aug. 1, 2002 (JP) 2002-225236

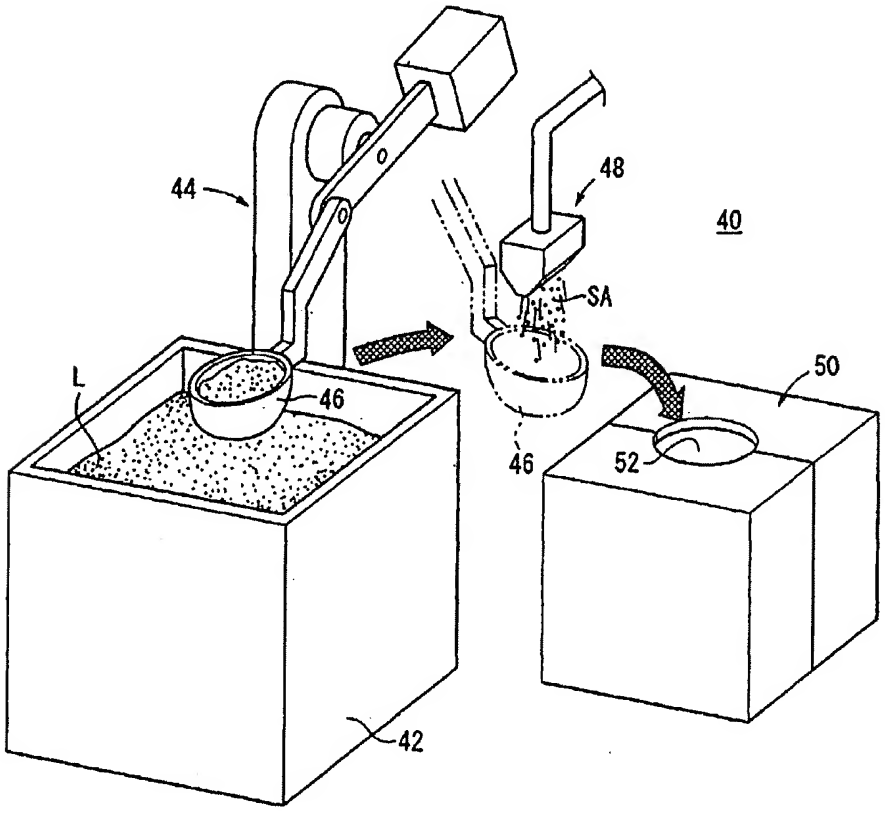
Publication Classification

(51) **Int. Cl.**
B22D 25/06 (2006.01)

(52) **U.S. Cl.** **164/58.1**

(57) **ABSTRACT**

A method for producing a metal material involves applying, to the surface of the ZAS alloy, an agent comprising a solvent and, dispersed therein, a material containing Cu such as Cu powder and a Cu—Mn alloy powder and preferably, dispersed or dissolved therein, a reducing agent capable of reducing an oxide film present on the surface of the ZAS alloy, and heating the ZAS alloy having the agent applied thereon, to thereby diffuse Cu into the alloy. The metal material comprises a Zn—Al—Sn based alloy (ZAS alloy) and Cu diffused in the alloy, wherein Cu is diffused into the inside of the alloy to a depth from the surface of 0.5 mm or more, the concentration of Cu decreases from the surface of the ZAS alloy towards the inside thereof, and there is present no specific interface between Cu and the ZAS alloy.



US007601389B2

(12) **United States Patent**
Kuwabara et al.

(10) **Patent No.: US 7,601,389 B2**
(45) **Date of Patent: Oct. 13, 2009**

(54) **METAL MATERIAL AND METHOD FOR PRODUCTION THEREOF**

(75) Inventors: **Mitsuo Kuwabara**, Tsurugashima (JP); **Tadashi Okada**, Saitama (JP); **Naoji Yamamoto**, Shizuoka-ken (JP); **Masahito Hasuike**, Hamamatsu (JP); **Hideo Yoshikawa**, Shizuoka-ken (JP); **Michiharu Hasegawa**, Mie-ken (JP); **Tetsuaki Aoki**, Kumamoto-ken (JP); **Masanori Kogawa**, Kumamoto-ken (JP); **Kazunori Sakamoto**, Kumamoto-ken (JP); **Keizou Tanoue**, Kumamoto (JP)

(73) Assignee: **Honda Giken Kogyo Kabushiki Kaisha**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 637 days.

(21) Appl. No.: **10/523,266**

(22) PCT Filed: **Jul. 31, 2003**

(86) PCT No.: **PCT/JP03/09737**

§ 371 (c)(1),
(2), (4) Date: **Nov. 9, 2005**

(87) PCT Pub. No.: **WO2004/013370**

PCT Pub. Date: **Feb. 12, 2004**

(65) **Prior Publication Data**

US 2006/0134453 A1 Jun. 22, 2006

(30) **Foreign Application Priority Data**

Aug. 1, 2002 (JP) 2002-225216
Aug. 1, 2002 (JP) 2002-225220
Aug. 1, 2002 (JP) 2002-225228
Aug. 1, 2002 (JP) 2002-225231
Aug. 1, 2002 (JP) 2002-225236

(51) **Int. Cl.**
B05D 1/12 (2006.01)

(52) **U.S. Cl.** **427/191**; 427/201

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,549,927 A * 8/1996 Cottone et al. 427/191
6,270,914 B1 8/2001 Ogasawara et al.

FOREIGN PATENT DOCUMENTS

JP 52-115749 9/1977

(Continued)

OTHER PUBLICATIONS

Takeshi Naito, Practical Operation Of Carburizing arid Quenching, First Edition, Aug. 30, 1979 p. 37.

Primary Examiner—Frederick J Parker
(74) *Attorney, Agent, or Firm*—Carrier, Blackman & Associates, P.C.; Joseph P. Carrier; William D. Blackman

(57) **ABSTRACT**

A metal material comprises a Zn—Al—Sn based alloy (ZAS alloy) and Cu diffused in the alloy, wherein Cu is diffused into the inside of the alloy to a depth from the surface of 0.5 mm or more, the concentration of Cu decreases from the surface of the ZAS alloy towards the inside thereof, and there is present no specific interface between Cu and the ZAS alloy; and a method for producing the metal material involves applying, to the surface of the ZAS alloy, an agent comprising a solvent and, dispersed therein, a material containing Cu such as a Cu powder and a Cu—Mn alloy powder and preferably, dispersed or dissolved therein, a reducing agent capable of reducing an oxide film present on the surface of the ZAS alloy, and heating the ZAS alloy having the agent applied thereon, to thereby diffuse Cu into the alloy.

8 Claims, 15 Drawing Sheets